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SPECIFICATION**WASHING MACHINE**

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Technical Field

[0001] The present invention relates to a washing machine capable of performing antimicrobial treatment on laundry.

Background Art

10 [0002] When performing washing with a washing machine, the user generally wishes to treat laundry with antimicrobial treatment. In response to such needs, various proposals have been made, of which examples are disclosed in the publications listed below. Specifically, Publication 1 discloses an electric washing machine equipped with an ion generator that generates metal ions, such as silver or copper ions, that exert a sterilizing effect. Publication 2 discloses a washing machine that sterilizes washing fluid by applying an electric field thereto. Publication 3 discloses a washing machine furnished with a silver ion adding unit that adds silver ions to washing fluid. Publication 4 discloses a washing machine that performs washing and rinsing by using electrolyzed water obtained through electrolysis of water. Washing machines that administer antimicrobial treatment by using silver ions have already been commercially available.

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Publication 1: Japanese Utility Model Application No. H5-74487 (p. 1, Fig. 1)

Publication 2: Japanese Patent Application Laid-Open No. 2000-93691 (p. 2, Fig. 1)

Publication 3: Japanese Patent Application Laid-Open No. 2001-276484 (p. 2, Fig. 1)

Publication 4: Japanese Patent Application Laid-Open No. 2003-24692 (pp. 3-6, Figs. 8, 10, 12, and 17)

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Disclosure of the Invention

Problems to be Solved by the Invention

[0003] When preparing water for performing antimicrobial treatment on laundry, it is most important to maintain water treatment performance. Through long-time use, water treatment performance deteriorates, eventually requiring some appropriate action to be taken for its restoration. If this action involves calling in an expert, it is too inconvenient and costly.

[0004] In view of the conventionally experienced inconvenience described above, it is an object of the present invention to provide a contrivance that permits a user to restore water treatment performance by him or herself with ease.

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Means for Solving the Problem

[0005] To achieve the above object, according to the present invention, a washing machine is constructed as follows.

[0006] Specifically, the washing machine according to the present invention includes a detachable cartridge-type water treatment unit that applies a voltage between electrodes and thereby elutes therefrom metal ions that exert an antimicrobial effect.

[0007] The washing machine has, in a water feed route for feeding water to a washing tub, a water feed port and a water receive port, which are arranged in the top surface of the washing machine.

[0008] On the other hand, the water treatment unit has, in a portion near one end of the bottom surface of an elongate case, an inflow port to be connected to the water feed port and an outflow port to be connected to the water receive port, and has, in a portion near the other end of the bottom surface of the case, connector portions for energizing the electrodes. Any of the inflow port, the outflow port, and the connector portions protrudes perpendicularly downward and the water treatment unit is fitted to the top surface of the washing machine by bayonet coupling.

[0009] With this construction, the cartridge type water treatment unit is fitted to the top surface of the washing machine; therefore, when metal ion elution capability of the water treatment unit deteriorates, the user can remove the water treatment unit and replace it with a new one by him or herself. Thus, it is possible to maintain the antimicrobial treatment of water functioning without calling in an expert. This arrangement of the water treatment unit on the exterior of the washing machine also reduces a risk of forgetting to fit the water treatment unit. Moreover, electric current that needs to be fed to the electrodes of the water treatment unit can be easily obtained from the washing machine. Moreover, the water treatment unit can be used until the life of the electrodes is reached, and, even when the life of the electrodes is reached, simply by replacing the water treatment unit, it is possible to continue treating laundry for a long period.

[0010] On the other hand, the water treatment unit has the inflow port and the outflow port in the portion near one end of the bottom surface of the elongate case, and has the connector portions in the portion near the other end of the case; therefore, the connection part through which to pass water and the connection part through which to

feed electric current can be arranged without the risk of interference. Any of the inflow port, the outflow port, and the connector portions protrudes perpendicularly downward; therefore, electrical connection and disconnection can easily be achieved when these components are attached to or detached from the washing machine.

5 Moreover, even without additionally providing a cover member, the connection part on the washing machine side including the water feed port, the water receive port, and the connectors do not become exposed. Further, the water treatment unit is fitted to the top surface of the washing machine by bayonet coupling; therefore, the water treatment unit can be attached and detached simply by being slightly rotated, thus

10 achieving easy and even secure attachment to and detachment from the washing machine.

- [0011] According to the present invention, in the washing machine described above, the water feed port and the water receive port are provided in a back panel on the top surface of the washing machine.
- 15 [0012] With this construction, the water feed port and the water receive port are provided in the back panel on the top face of the washing machine; therefore, to attach the water treatment unit to the washing machine, the connector portions can be first connected together above the back panel, and then the inflow port and the outflow port can be respectively connected to the water feed port and the water receive port.
- 20 [0013] According to the present invention, in the washing machine described above, in the back panel, recesses are formed into which the connector portions are inserted. The connectors arranged in the recesses are connected to the connector portions.
- [0014] With this construction, by connecting the connectors arranged in the recesses formed in the back panel to the connector portions, the water treatment unit is

electrically connected to the electrodes.

[0015] According to the present invention, in the washing machine described above, the connectors are connected to leads that are laid with a predetermined margin.

[0016] With this construction, the connectors are connected to the leads that are laid with the predetermined margin; therefore, with the connectors taken out above the back panel, they can be connected to and disconnected from the connector portions.

[0017] According to the present invention, in the washing machine described above, both the inflow port and the outflow port have circular sectional shapes and are arranged coaxially.

10 [0018] With this construction, both the inflow port and the outflow port have circular shapes and are arranged coaxially; therefore, as compared with one in which the inflow port and the outflow port are formed in different places, the water treatment unit can be easily connected to the washing machine, and the connection part can be made compact. Moreover, watertight sealing between the water treatment unit and the washing machine can be achieved with a simple structure. Further, the inflow port and the outflow port are arranged coaxially; therefore, attachment and detachment achieved by the bayonet coupling, whereby the case is attached to the washing machine by being twisted and detached from the washing machine by being reversely twisted, can be performed easily.

15 20 [0019] According to the present invention, in the washing machine described above, after fitted to the washing machine by bayonet-coupling, the water treatment unit is fixed to the washing machine by being prevented from rotating.

[0020] With this construction, after fitted to the washing machine by the bayonet-coupling, the water treatment unit is fixed to the washing machine by being prevented

from rotating; therefore, the water treatment unit is firmly fixed to the washing machine.

[0021] According to the present invention, in the washing machine described above, the water treatment unit has the electrodes extending from near the connector portions toward the outflow port, and has, inside the case, a partition wall formed for guiding water that has flowed in through the inflow port toward the parts of the electrodes near the connector portions.

[0022] With this construction, the water treatment unit has the electrodes extending from near the connector portions toward the outflow port, and has, inside the case, the partition wall formed for guiding the water that has flowed in through the inflow port toward the parts of the electrodes near the connector portions; therefore, water can be made to flow along the entire length of the electrodes so that metal ions can be eluted fully. Moreover, the electrodes can be given a necessary and sufficient length, and in addition, since they can be formed rectilinear, they are easy to produce.

[0023] According to the present invention, in the washing machine described above, the partition wall forms a dead-end passage that is open at one end and closed at the other. The outflow port is located at the closed end of this dead-end passage. The inflow port is open toward outside the partition wall. Inside the dead-end passage, the electrodes are arranged parallel to and at a predetermined interval from each other. The water that has flowed in through the inflow port is guided along the outside of the partition wall to the entrance of the dead-end passage. The water then enters the dead-end passage, and then flows along the length of the electrodes toward the outflow port.

[0024] With this construction, the partition wall forms the dead-end passage that is open at one end and closed at the other. The outflow port is located at the closed end of this dead-end passage. The inflow port is open toward outside the partition wall. Inside the dead-end passage, two electrodes are arranged parallel to and at the predetermined interval from each other. The water that has flowed in through the inflow port is guided along the outside of the partition wall to the entrance of the dead-end passage. The water then enters the dead-end passage, and then flows along the length of the electrodes toward the outflow port. Therefore, under the design condition that the inflow port and the outflow port are arranged in the portion near one end of the elongate case, and the connector portions are arranged in the portion near the other end of the case, the water can be made to flow along the entire length of the electrodes.

Advantages of the Invention

[0025] According to the present invention, the cartridge-type water treatment unit is fitted to the top surface of the washing machine. Therefore, when metal ion elution capability of the water treatment unit deteriorates, the user can remove the water treatment unit and replace it with a new one by him or herself. Thus, it is possible to maintain the antimicrobial treatment of water functioning without calling in an expert.

[0026] The water treatment unit is arranged on the exterior of the washing machine. This therefore reduces a risk of forgetting to fit the water treatment unit. Moreover, the electric current that needs to be fed to the electrodes of the water treatment unit can be easily obtained from the washing machine. Moreover, the water treatment unit can be used until the life of the electrodes is reached, and, even when the life of the electrodes is reached, simply by replacing the water treatment unit, it is possible to

continue treating laundry for a long period.

Brief Description of Drawing

[0027] Fig. 1 is a vertical sectional view of a washing machine embodying the invention.

Fig. 2 is a vertical sectional view schematically showing the water feed port.

Fig. 3 is a flow chart of the entire washing procedure.

Fig. 4 is a flow chart of the washing process.

Fig. 5 is a flow chart of the rinsing process.

Fig. 6 is a flow chart of the spin-drying process.

Fig. 7 is a perspective view of the components arranged on the top face of the washing machine.

Fig. 8 is a plan view of the water treatment unit.

Fig. 9 is a bottom view of the water treatment unit.

Fig. 10 is a plan view of the base of the case of the water treatment unit.

Fig. 11 is a vertical sectional view taken along line A-A in Fig. 10.

Fig. 12 is a vertical sectional view taken along line B-B in Fig. 10.

Fig. 13 is a vertical sectional view taken along line C-C in Fig. 10.

Fig. 14 is a side view of the water treatment unit.

Fig. 15 is a vertical sectional view taken along line D-D in Fig. 10.

Fig. 16 is a vertical sectional view taken along line E-E in Fig. 10.

Fig. 17 is a vertical sectional view taken along line F-F in Fig. 10.

Fig. 18 is a partial vertical sectional view of the washing machine having the water treatment unit attached thereto.

Fig. 19 is a partial vertical sectional view of the washing machine having the water treatment unit attached thereto, taken along a line perpendicular to Fig. 18.

Fig. 20 is a drive circuit diagram of the water treatment unit.

Fig. 21 is a flow chart showing the sequence for adding metal ions.

List of Reference Symbols

[0028]	1	Washing machine
	10	Cabinet
	20	Water tub
10	30	Washing tub
	33	Pulsator
	40	Drive unit
	50	Water feed valve
	53	Water feed port
15	68	Drain valve
	80	Controller
	81	Operation/display unit
	100	Water treatment unit
	101	Case
20	107	Inflow port
	108	Outflow port
	112	Connector portion
	113, 114	Electrodes

- 120 Drive circuit
- 130 Central controller
- 171 Water feed port
- 172 Water receive port

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Best Mode for Carrying Out the Invention

[0029] Hereinafter, an embodiment of a washing machine according to the present invention will be described with reference to Figs. 1 to 21.

[0030] Fig. 1 is a vertical sectional view showing the overall construction of a washing machine 1. The washing machine 1 is of the fully automatic type, and has a cabinet 10. The cabinet 10 is box-shaped, is formed of a metal or synthetic resin, and has openings at its top and bottom. The top opening of the cabinet 10 is covered with a top plate 11, which is formed of a synthetic resin and is fixed to the cabinet 10 with screws. In Fig. 1, the front and rear of the washing machine 1 point leftward and

and variations are possible within the scope of the present invention. For example, the water treatment unit may be used not in a "horizontal posture" as in the embodiment described above but also in a "vertical posture," i.e., with the length direction of the case aligned vertically and the inflow port and outflow port protruding horizontally, or in a "sideways posture," i.e., with the length direction of the case aligned horizontally and the inflow port and outflow port protruding horizontally. Water may be treated not by elution of metal ions but by production of electrolyzed water or in any other manner.

10 **Industrial applicability**

[0123] The present invention is applicable to washing machines.

CLAIMS

- [1] (Corrected) A washing machine comprising a detachable cartridge-type water treatment unit that applies a voltage between electrodes and thereby elutes therefrom metal ions that exert an antimicrobial effect, wherein, in a water feed route for feeding water to a washing tub, there are provided a water feed port and a water receive port, which are arranged in a top surface of the washing machine, wherein the water treatment unit has, in a portion near one end of a bottom surface of an elongate case, an inflow port to be connected to the water feed port and an outflow port to be connected to the water receive port, and has, in a portion near the other end of the bottom surface of the case, connector portions for energizing the electrodes, any of the inflow port, the outflow port, and the connector portions protruding perpendicularly downward, and wherein the water treatment unit is fitted to the top surface of the washing machine by bayonet coupling.
- 15 [2] (Corrected) The washing machine of claim 1,
wherein the water feed port and the water receive port are provided in a back panel on the top surface of the washing machine.
- 20 [3] (Corrected) The washing machine of claim 2,
wherein, in the back panel, recesses are formed into which the connector portions are inserted, and wherein the connectors arranged in the recesses are connected to the connector portions.
- [4] (Corrected) The washing machine of claim 3,

wherein the connectors are connected to leads that are laid with a predetermined margin.

- [5] (Corrected) The washing machine according to any of claims 1 to 4,
5 wherein both the inflow port and the outflow port have circular sectional shapes and
are arranged coaxially.
- [6] (Corrected) The washing machine of claim 5,
wherein, after fitted to the washing machine by bayonet coupling, the water treatment
10 unit is fixed to the washing machine by being prevented from rotating.
- [7] (Corrected) The washing machine of claim 5,
wherein the water treatment unit has the electrodes extending from near the connector
portions toward the outflow port, and has, inside the case, a partition wall formed for
15 guiding water that has flowed in through the inflow port toward parts of the electrodes
near the connector portions.
- [8] (Corrected) The washing machine of claim 7,
wherein the partition wall forms a dead-end passage that is open at one end and closed
20 at the other, wherein the outflow port is located at the closed end of the dead-end
passage, wherein the inflow port is open toward outside the partition wall, wherein,
inside the dead-end passage, the electrodes are arranged parallel to and at a
predetermined interval from each other, and wherein the water that has flowed in
through the inflow port is guided along the outside of the partition wall to an entrance

of the dead-end passage, then enters the dead-end passage, and then flows along the length of the electrodes toward the outflow port.

[9] (Deleted)

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[13] (Deleted)